FAST HOMOGENIZATION ALGORITHM BASED ON ASYMPTOTIC THEORY AND MULTISCALE SCHEMES

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ABSTRACT. A time-frequency interpretation of the classical asymptotic theory of homogenization of elliptic PDEs with periodic coefficients by means of known multilevel/multiscale numerical schemes is investigated. The knowledge of the relations between these two different approaches is leading to formulate a new fast iterative algorithm for the approximation of homogenized solutions. In fact, the asymptotic homogenization process can be interpreted as a migration to infinity of the frequencies related to microscales contributions and the discovering of those related to the homogenized solution. Recursive low-pass filtering, at different scales/frequency of the periodic coefficients of the operator, selects only the contributions of the homogenized solution which is composed as limit of this procedure. This novel method can be interpreted as a generalized non-stationary subdivision scheme and its convergence and stability is discussed. In particular, stable compositions of the homogenized solution are investigated in relation to the contraction behavior of specific operators generated by reduction processes and Schur complements with respect to wavelets and multiscale bases.

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